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IRRIGATION IN ALBERTA PARKLAND

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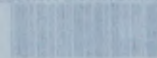
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IRRIGATION IN ALBERTA PARKLAND

Introduction

Irrigation in the Aspen Parkland areas of Alberta has not assumed the importance it has in southern Alberta. However, at the present time a number of farm operators are making use of irrigation in a variety of commercial farm operations. This paper will attempt to show present uses for irrigation, illustrate the extent of its potential, its need and if possible, project the future of irrigation in the parkland areas.

There are two major parkland areas in Alberta (Figure 1)¹. Since administrative boundaries do not coincide with the ecological ones, all agricultural areas north of Township 33 are included in the discussion.

At present all irrigation in these areas is undertaken by private individuals or a group of individuals, with very little assistance other than technical aid. Technical assistance has been available from both the Prairie Farm Rehabilitation Administration and the Water Resources Division, formerly of the Department of Agriculture and now of the Department of the Environment. The Land Development Branch of the Water Resources Division provides a farm advisory service for sprinkler and gravity forms of irrigation for licensing purposes. Table 1 provides a summary of requests and action taken on these requests.

1 Multiple resource management guide for crown lands of Alberta., 1971. government of the province of Alberta.

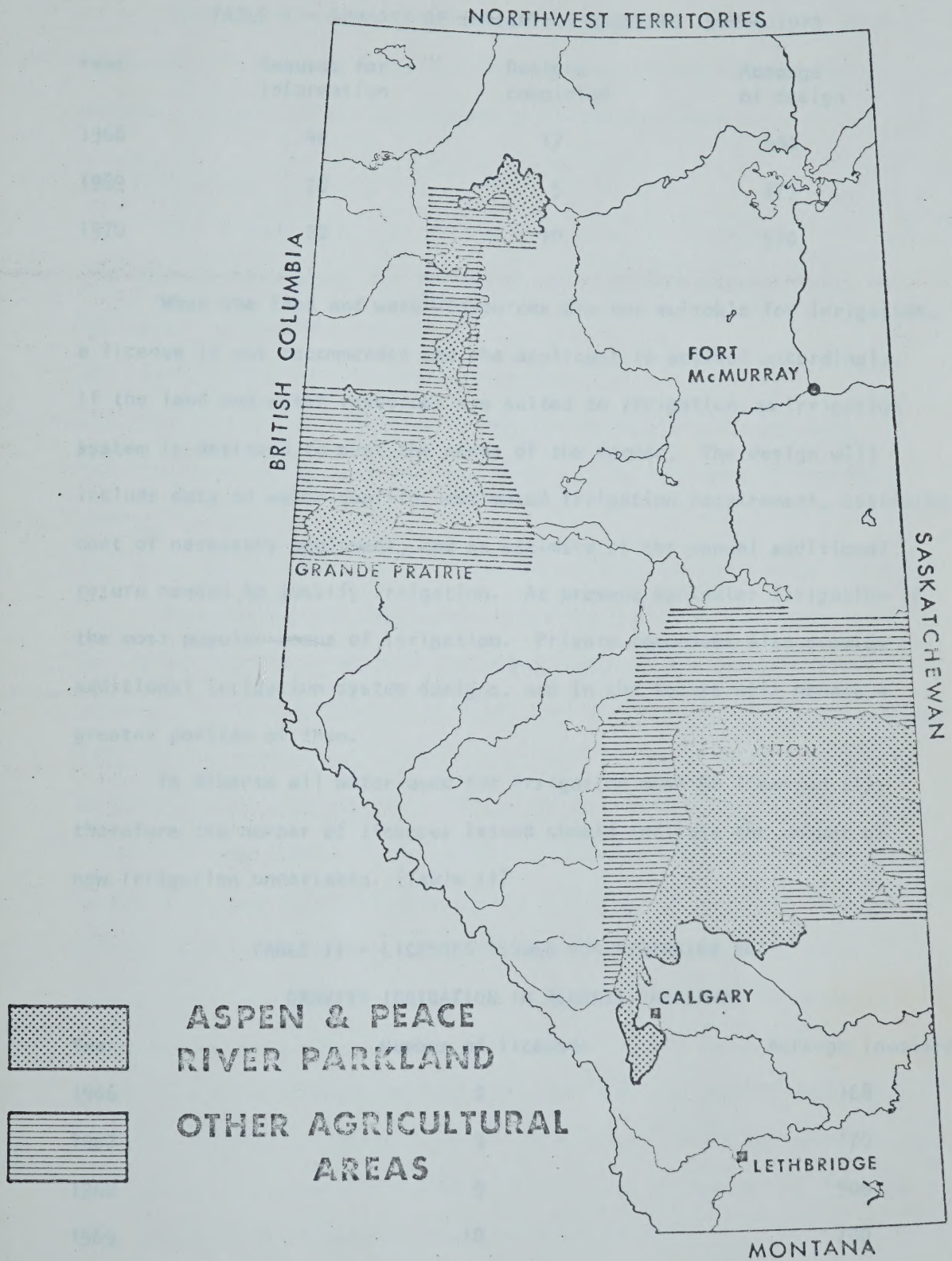


FIGURE No. 1

TABLE I - SUMMARY OF IRRIGATION REQUESTS 1968 - 1970

Year	Request for information	Designs completed	Acreage of design
1968	46	17	900
1969	28	5	277
1970	22	10	570

When the land and water resources are not suitable for irrigation, a license is not recommended and the applicant is advised accordingly. If the land and water resources are suited to irrigation, an irrigation system is designed to meet the needs of the farmer. The design will include data on water quality, estimated irrigation requirement, estimated cost of necessary equipment, and an estimate of the annual additional return needed to justify irrigation. At present sprinkler irrigation is the most popular means of irrigation. Private companies also provide additional irrigation system designs, and in the future will handle a greater portion of them.

In Alberta all water used for irrigation must be licensed (1); therefore the number of licenses issued should indicate the amount of new irrigation undertaken. (Table II)

TABLE II - LICENSES ISSUED FOR SPRINKLER AND GRAVITY IRRIGATION IN ALBERTA PARKLANDS

Year	Number of licenses	Acreage involved
1966	2	168
1967	3	170
1968	9	900
1969	10	700
1970	9	330

TABLE 1 - SUMMARY OF INVESTIGATION REQUESTS 1965 - 1970

Year	Request for information	Design completed	Amount of design
1965	42	17	500
1966	15	2	217
1970	22	10	370

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TABLE 2 - REQUESTS FOR DESIGN FOR GRAVITY TREATMENT BY ALBERTA PROVINCE

Year	Number of requests	Design completed
1965	2	1
1967	2	1
1968	3	2
1969	10	5
1970	2	1

However, the actual acreage under irrigation will be variable since not all licensed areas will be irrigated in any single year. Moreover, not all irrigation systems are properly licensed.

Why Irrigation

The increasing use of irrigation can be attributed to:

- (1) Economic pressures for increasing agricultural production to maintain a viable farm unit.
- (2) Availability of technical assistance.
- (3) Availability of effective irrigation equipment and techniques.
- (4) The critical demands for both high quality and yield of specialty crops.
- (5) A desire to make more effective use of the available water resources.

Discussion with individual irrigators indicates that most are irrigating for one or more of the above reasons. For example, Mr. E. Johnson, of the Wetaskiwin area feels that sprinkler irrigation is essential for the continuance of his dairy farm. To maintain milk production he had found it necessary to purchase and ship approximately 100 tons/year of alfalfa from Brooks in the Eastern Irrigation District. He felt that he could replace this purchased hay by irrigating 35 acres of land he already owns. This system was sufficiently successful in its initial year of operation that Mr. Johnson now intends to expand the system to irrigate 105 acres and to increase his herd size. A second similar case is Mr. Patterson, irrigating from Hastings Lake, who reports doubling his hay yield through irrigation. After two years of use he replaced his hand move sprinkler system with a side roll sprinkler system and at the same time increased his irrigated area from 60 to 90 acres.

Both of the above farmers have utilized the technical assistance services offered by the Land Development Branch and have followed the suggestions made. In each case, when the system was to be expanded, we were again approached for assistance. These farmers both found that advice on equipment, costs, and moisture requirements allowed them to study other alternatives before approaching irrigation equipment sales agencies.

The improvements in sprinklers and pipes and the introduction of better mechanical move systems have allowed the irrigator to select equipment that suits his needs. The new equipment generally minimizes labour while remaining trouble free.

Special crops found in the Alberta Parkland areas are grass sod, potatoes, other vegetables and nursery stock. A large portion of these crops is grown in the Edmonton area. Approximately 1000 acres are irrigated annually by eight operators. A further 200 to 300 acres of market garden crops are irrigated along the Peace River for local consumption. Each of these specialty crops has its own critical water demands for germination, quality control, as well as increased yield.

A desire to conserve available water has encouraged development of a number of irrigation projects, most of which involve backflood irrigation. For those not familiar with this type of irrigation, backflooding is the retention of runoff water either naturally or by structures to flood areas outside of the natural drainage channel. It is usually a "one shot irrigation", with drainage of flood water after a short period of flooding. The water that infiltrates during the period of immersion is available for plant growth. In the past several years an irrigation project of this type has been developed along Ribstone Creek near Wainwright, Alberta. This stream drains approximately 1160 square miles. Numerous hay flats along its course have been troubled by summer floods which have either

prevented harvest or destroyed the crop. The first step was to improve the creek's channel so that drainage was possible, and the second step was to construct works to permit spring irrigation. In this area, the additional moisture provided by spring irrigation is very important to the hay crops and often means the difference between a good crop and none at all. About 2000 acres are irrigated by this project.

Several sprinkler systems for irrigating gardens or nursery stock have been designed to utilize collected runoff. These systems are generally limited to less than ten acres, depending on runoff, storage facilities, and cost.

Irrigation Requirement

Irrigation is limited to those areas which have both a suitable soil and an available water supply. Since the cost of irrigation in the parkland areas is borne by the irrigator, irrigation will be restricted to the area where water is available. Numerous backflood irrigation schemes have been developed in a number of intermittent streams but sprinkler irrigation has been limited to within one mile of flowing streams. Surface irrigation methods other than backflooding have been used in several locations, but have been replaced by sprinkler systems.

At present crops responding to irrigation are hay, pasture, potatoes, other vegetables, and commercial sod. Irrigation of grain crops will generally not produce economic returns.

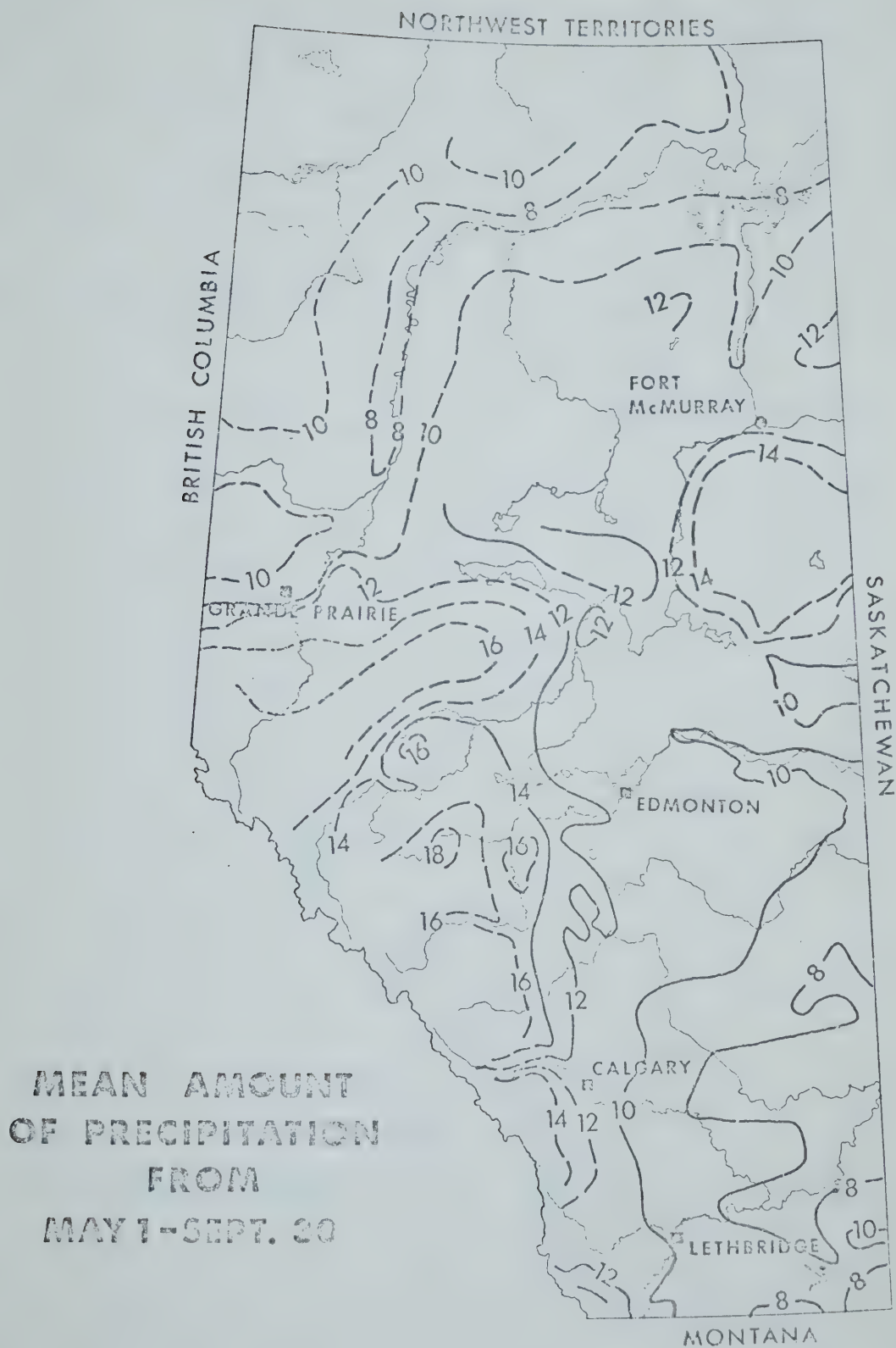
It is very difficult to estimate a net irrigation requirement for agricultural crops in the parkland areas because of the variation encountered in both the amount of precipitation and its distribution during the growing season. At the present time, an annual growing season moisture deficit of 8 - 10 inches is used when designing sprinkler

irrigation systems (7) and these systems have generally provided adequate protection against drought over the specified areas. Since this magnitude of drought is encountered in approximately only 25 percent of the years (5), many farmers increase the acreage irrigated beyond the amount for which the system was designed.

It is interesting to examine the climatic data to see the size of potential moisture deficit indicated. Figures 2 & 3, indicate the average precipitation (May to September)(2), and potential evapotranspiration respectively (5). The two designated areas are those of current interest. A comparison of the two figures indicates that the designed areas will have a potential moisture deficit of 6 to 12 inches during the growing season (May to September), if no allowance is made for storage of moisture by the soil. Soil moisture storage under the conditions found in the parkland areas is variable depending on frost, thawing conditions, soil type and the previous fall's precipitation. In general, soil storage will account for 0 to 4 inches of moisture. Actual average potential moisture deficit will be 6 to 8 inches.

The actual moisture deficit developed by agricultural crops may be less, equal to, or greater than this potential moisture deficit. In general in the Alberta parklands, the moisture deficits experienced by forage crops will be slightly less than the potential deficit, and by grains considerably less.

Besides the average moisture deficit, temporary moisture deficit or surplus will occur because of uneven distribution of rainfall. It appears that this distribution of rainfall is responsible for most of the severe droughts producing serious crop loss. To illustrate the range of variation in monthly rainfall distribution, the maximum and minimum and average precipitation for Edmonton is given in Table III(4).



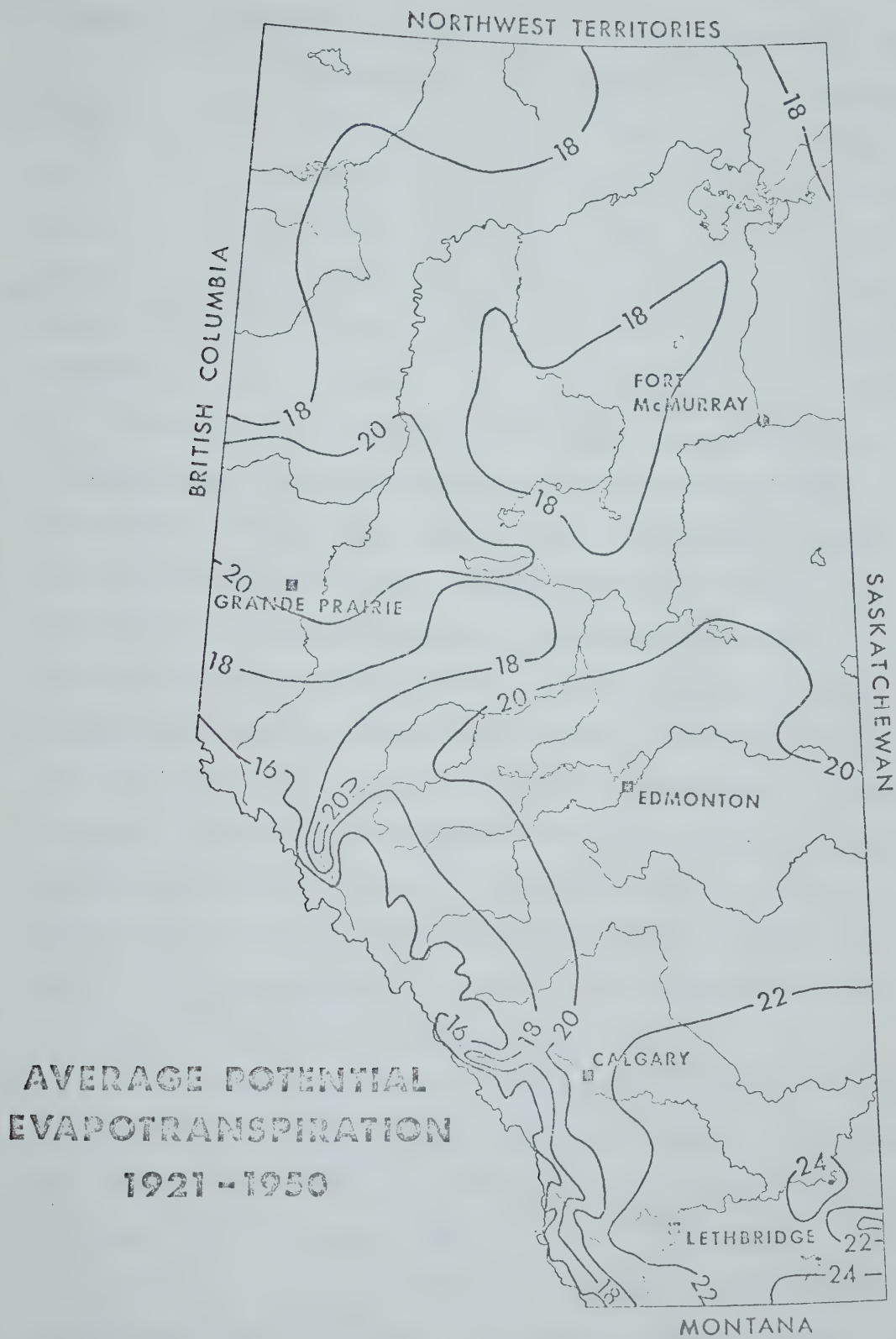


FIGURE No. 3

TABLE III - DISTRIBUTION OF PRECIPITATION BY MONTH FOR EDMONTON IN INCHES

	Maximum	Minimum	Average
April	2.52	.01	1.10
May	7.67	.10	1.83
June	8.53	.45	3.15
July	11.13	1.28	3.34
August	6.44	.03	2.55
September	4.32	.03	1.35

When this data is examined year by year, it appears that the arithmetic mean is biased by the few years with much above average precipitation. The average monthly rainfall is inadequate to supply most crops needs; hence a slowly accumulating deficit will occur. If the rainfall is less than average, serious drought can quickly occur, and if not corrected, cause crop loss. Experience has indicated two periods which have the greatest risk of drought. The first period consists of May and early June, and the second is the month of August. These two periods of drought have their greatest effect on forage crops but only minimal effect on grain crops. If sufficient moisture is present to germinate grain, the June and July rains will generally provide adequate moisture for crop production. If severe drought occurs when grain is heading or filling, serious crop loss is possible.

The Land Development Branch in cooperation with several farmers has been carrying out a program of investigating the potential of irrigation under the conditions described. From the limited data now available the following facts are becoming evident:

(1) Irrigation of grain would rarely prove effective, and only when severe drought restricts germination or prevents grain development.

- (2) Irrigation will increase alfalfa hay yields by 1.0 to 1.5 tons/acre when average or slightly above average growing season precipitation is received. Potential alfalfa yields of four to five tons of hay per acre appear possible.
- (3) In our work high levels of soil moisture in the fall appear to increase winter kill of alfalfa. If this actually is occurring, late summer and fall irrigation will not be desirable.
- (4) Irrigation is required for vegetables, tree nursery stock, and commercial sod production to promote germination, and to obtain desired quality and yields.
- (5) Irrigation scheduling becomes a major problem with very costly consequences. Irrigation scheduling in the parkland areas must consider the probability of receiving additional rainfall and thus attempt to eliminate unnecessary irrigation. By following the information provided in "Risk Analysis of Weekly Climatic Data for Agricultural and Irrigation Planning" (3), one irrigation out of the three indicated for the Edmonton area in each of the past two years could have been eliminated. In each case rain occurred before soil moisture was reduced to a deleterious level.

Irrigation in the Future

Irrigation will continue to develop in the parts of the parklands where suitable soils are adjacent to water available for irrigation purposes. The individual undertaking irrigation projects will continue to bear the responsibility of insuring that such developments meet the regulations set out in the Water Resources Act.

In the future there will be a modest increase in irrigated acreage planted in vegetables, grass sod and tree nursery stock to meet the local demands generated by developing urban areas. The use of irrigation to

produce forage crops of hay and pasture to meet the needs of an increased cattle population will become more widespread. Increased mechanization of irrigation will continue.

In 1968 all the irrigation systems designed by Land Development in the parkland area were hand move sprinkler irrigation systems. In 1970 almost all the systems where conditions were suitable, were designed as side roll systems. The side roll system reduced labour and increased the number of acres irrigated to a great enough extent to offset the original capital spent. Total Estimated cost to irrigate per acre for both types of systems ranged between \$20 and \$30 per acre. Actual operating cost¹ as reported by several farmers using irrigation would indicate that these estimates of per acre cost are high. The lower cost figures result from increasing the acreage irrigated to an amount greater than that indicated in the design.

Conclusion

Irrigation has a definite place in agriculture in the parkland areas of Alberta. Its role will become more important in the future because it can assure and increase a given yield level during most years. Improved designs of sprinkler irrigation systems to lower per acre cost will be required.

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